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ABSTRACT

An examination of the views of Piaget on child development and a review of criticisms of his theories illustrate the general problem of applying psychological theories to educational practice. It is concluded that educators are largely ignorant of what children know and their ways of coming to know, especially as these operate in real time conditions such as classrooms. It is argued that it is of prime importance to understand teachers' thinking about how children think, since this influences the teachers' behavior and expectations. The difficulty of conducting research in this complex and subjective area is pointed out. Two studies that attempted to analyze the way teachers think about students are described. The first obtained teachers' views of childrens' difficulties with tasks in a mathematics scheme and explored teachers' thinking on what to do about these difficulties. The second explored how teachers match tasks to children so as to maximize their learning progress. The implications of the results of these studies are discussed. (JD)

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TEACHERS' THINKING ABOUT CHILDREN'S THINKING

Paper presented to the 11th annual international conference on Piagetian theory and the helping professions.

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The issue examined in this paper lies within the general problem of applying psychological theories to educational practice. This is a very general concern and anxieties about the problems of implementation and the apparent lack of impact of theory on practice have been widely expressed (Atkinson, 1976; Ausubel, 1969; Farnham Diggory, 1976; Glaser, 1978; James, 1899; Piaget, 1970).

In the first section below, some problems in applying Piagetian developmental psychology to practice are reviewed.

It is then argued that there is a further, complex problem which is not typically treated. The problem is that teachers have a large body of knowledge about children and this knowledge is accumulated during the teachers' work in the classroom. Why this poses a problem for those seeking to influence practice and how teachers' knowledge could and should become a rich research field are then examined and illustrated.

It will be argued that efforts to apply theory to practice will always be disappointing until a better understanding is generated of the conditions under which practice takes place. In particular practice impinges on teachers' thinking about children and whilst this thinking is subjective and contingent it cannot be ignored. To be amended, teachers' thinking and the forces which produce it must be comprehended.

APPLYING DEVELOPMENTAL PSYCHOLOGY TO EDUCATION

Developmental psychologists have attempted to inform educational debates on questions such as, 'What should children learn? What is the optimum time to learn and what is the ideal structure and sequence of learning?

However, associated with these efforts to influence educational practice are a number of standard criticisms and problems. If interest is confined to the application of Piaget's genetic psychology to educational practice the following problems are well known.

Some critics hold the view that there is far too much wrong with the basic theory and on this basis it is premature to apply it to practical settings. (Brainerd 1978; Brown and Desforges, 1979; Donaldson, 1978; Sullivan, 1967; for example) It was Piaget's own view that the difference between his educational 'message' and that of some of his distinguished predecessors such as Pestalozzi, was that Piaget's view was based on sound epistemological analysis and valid and reliable psychological observation and theory (Piaget, 1970). Thus, any criticism of the validity of the theory must be taken very seriously by educators.

Other critics hold the view that whether Piaget's theory is valid or not in terms of its account of natural development, it has no logical or necessary educational implications (Bereiter and Scardamalia, 1977; Engelman, 1971). A concern for what is natural is not a necessary foundation for a concern for what is desirable.

A third strand of criticism is that, valid or not, Piaget is simply not clear or indeed may be seen to be totally ambiguous as a source for educational prescription on important issues. (Kuhn, 1979) With respect to the problem of matching tasks to children, for example, Kuhn shows that Piagetian texts may be used to foster either a 'jacking up by practice' policy or a 'leading by the nose by Socratic questioning' policy. The ambiguity cannot be resolved by examination of the texts and has proved difficult to resolve empirically. (Brown and Desforges, 1979)

A fourth type of criticism is that Piagetian psychology is simply impractical. Kuhn (1979) has argued that Piagetian prescriptions for diagnosis, for example, simply take up too much time when a teacher is faced with 30 children. With respect to practical outcomes, Piagetian procedures have not been shown to be very effective in comparison with alternative procedures even when the judgement criteria have conformed to Piagetian specifications. (Brainerd, 1977; Sheppard, 1974; Zimmerman and Rosenthal, 1974)

Finally, there is a fimiliar body of criticism from within the Piagetian camp of those workers who have, it is argued, misused Piaget's theory. There are those, for example, who have designed curriculums based on the teaching of key Piagetian concepts such as transitivity and conservation and there are others who have designed standardised tests so that children can be consigned to stages, (Schayer et al, 1976, for example). These workers have been criticised for reifying content and missing the essential point of the epistemic subject. (Gallagher and Easley, 1978).

These then are the familiar classes of criticism which are typically directed at those who apply Piagetian developmental psychology to educational practice. It is worth noting that an isomorphic body of critism is applied to a variety of forms of neo-Piagetian developmental theory. (For a critique of information processing theories of development as they apply to education see Desforges and McNamara, 1977 and for a similar critique of the work of neo-Piagetians such as Case, see Flavell, 1978).

Since these criticisms are directed not only at the theory itself (an 'object' which, in any event is likely to be in a continuous state of flux because that is the nature of theory) but at its interpretation and application, it is clear that the critics are unlikely to be satisfied merely by tinkering with the pure theory.

I think it is an honest and not too humble a conclusion to say that what these criticisms might add up to is that we are <u>largely ignorant of what children know and their ways of coming to know especially as these operate in real time conditions such as classrooms</u>.

<u>USING TEACHERS' THINKING.</u>

It is for these reasons that Kuhn (1979) has recently argued that any further growth of developmental psychology is more likely to be productive if it is seen as a joint venture between psychologists and educational

practitioners such that working in collaboration they might mutually inform each other's theory and practice. This view is attractive but there are at least two other reasons why attention must be turned to what teachers know about children's thinking both of which would commend themselves to those of a Piagetian pursuasion.

The first is that almost all the children studied, whether in laboratories or schoolrooms, have been subjected to the influence of schooling. The management of this large and coherent body of experience is in the hands of class teachers and it is much to the discredit of Piagetian psychology that whilst the 'impact of schooling' has been seen to be an important research issue it has been very inadequatley conceptualised. 'Schooling' has been construed in terms of 'years of attendance' and the general conclusion that schooling influences cognition might somewhat kindly be said to be bland. Thus, crucial forces on children's experience have not been researched adquately.

There are those who might argue that we need not comprehend schooling as it is presently conducted. (Glaser, 1978); we must seek to optimise it. Whether this view is taken seriously or not any attempt to tell teachers what is known about children's thinking must face up to two crucial facts, well known to Piagetians but generally ignored in their educational message. First, whatever is told does not fall onto a blank slate. It is received into the teachers' own schemes and is subject to a great deal of assimilation. Secondly, whatever is told them is a very minor proportion of input in terms of their experience with children. It is not claimed that this experience represents fundamental, theoretically sound understanding. It is inevitable however that this experience is schematic and that it guides her practice. This is assumed in attempts to influence it but the implications of this assumption have not been taken seriously.

In summary of this section, it is argued that we must understand teachers' thinking about children's thinking for a least three reasons. First, what the teacher thinks, influences how she behaves with her children and as a consequence influences the children who are the subjects of our research. Secondly, her knowledge is task specific and concerns educational contents in a way that developmental research typically does not. And third, if we are to teach we must understand the mental life and contents of the recipients of our teaching. It is important to stress that it is not only the schematic form of the teacher's knowledge which is a matter of interest. An understanding of the forces which shape this form must also be striven for. The optimisation of teachers' behaviour is unlikely to be achieved by prescription and exhortation. It is more likely to proceed on action based on the comprehension of those contexts in which teachers operate.

PROBLEMS IN RESEARCHING TEACHERS' THINKING.

However, whilst the potential payoff of research in this area is enormous (in terms of acquiring knowledge about experience and the growth of understanding in a working relationship which enhances the chances of optimising that experience) the problems of conducting such research are daunting. In the following sections some of the problems are discussed using examples of recent research.

Three closely interrelated classes of problems may be identified. There are problems of how teachers' thinking might be conceptualised as a preliminary to research. Secondly there are problems in relating 'thinking about practice' to practice itself because only the teachers' practice impinges on the children. And thirdly, there are problems of methodology; how are data on teachers' thinking to be got?

With reference to the nature of teachers' thinking there is no claim that teachers have a superior form of learning theory or a sound theoretical

edifice to comprehend children's behaviour. It is clear however that competent teachers have a 'working knowledge' of children based on a large and rapidly accumulated experience of teaching them. It is shown later that such a derogatory view of teachers' knowledge is likely to be an artefact of the methods used to research this area. In so far as the above authors used data at all, they assigned teachers' responses to very general questions into sociological categories. They asked for generalities and got generalities. Thus, despite the pessimistic conclusions of some authors it is assumed that teachers have a rich store of knowledge regarding children.

This knowledge is subjective, typically unarticulated and generally unexamined. Additionally it is accumulated under very poor problem solving conditions demanding large numbers of quick decisions made under constant pressure from a wide range of sources.

How might this knowledge be made public and thence open to examination, codification and analysis?

The obvious method is to talk to teachers but at least one signigicant researcher has noted that whilst teachers made over one thousand decisions per day they have almost no technical vocabulary with which to articulate the basis for these decisions. (Jackson, 1968) Rather than lack of vocabulary, however, it might equally be the case that teachers are simply inexperienced at articulating their professional knowledge and that any research procedure used should involve a period of acclimatisation to this new demand.

One final point to be made in this preliminary discussion of problems is that any conversation must have an agenda. It is likely that the kinds of data derived from talks to teachers will depend quite critically on the subject of the conversation. The point has already been made that invitations to talk about very general issues (such as 'children in

general' or 'learning in general') are bound to lead to vague generalities. In the work reported below, conversation has always moved towards the most specific level - towards talk about specific acts by specific children doing specific tasks.

The following study illustrates these problems and raises a number of other issues for work in this field.

STUDY ONE.

The aim of this study was to obtain teachers' views of children's difficulties with tasks in a matematics scheme and to explore teacher's thinking on what to do about these difficulties.

The mathematics scheme used was 'Mathematics for Schools' (Fletcher, 1970). It is a scheme very widely used in England.

A sample of fifty teachers (each of whom had received an inservice course on how to use this particular scheme) was asked to identify tasks in the scheme which caused most children problems. In this way a set of tasks perceived to cause difficulty was identified.

A subset of twelve teachers then took part in detailed and extensive interviews. Each teacher was asked what it was about the task that made children fail. The teachers invariably generated a number of possibilities.

After each speculation they were asked why they thought that that was the problem and how they could check their hunch.

Finally, they were asked what, in practice, they did with this particular task.

The discussions surrounding two tasks are reported below for illustrative purposes. The tasks here are from the very early part of the scheme. That is to say, they would typically be met by 5 year old children.

The first task used for illustration is presented as it appears in the child's workbook in fig.1. The word 'blue' in the set indicates to the children that they must colour each car blue. According to the teacher's guidebook the object of this exercise is to test a knowledge of colour names and some understanding of the idea of a set.

fig 1 about here

According to the teachers interviewed, most children answered 'yes' to the first question and 'no' to the third question and these were judged by teachers to be the correct answers. However most children, it appears, answer 'yes' to the second question and were judged to be wrong.

The twelve teachers proffered the following reasons for the children's confusion:-

Ten said that the usual answer to a teacher's question was 'yes'. They very rarely meet questions to which the answer is 'no'.

The response was made eight times that children possibly think that they are getting the same question twice. Questions one and two are very similar except for the word 'blue'. The children therefore give the same answer.

A third common response also given eight times as a possible account of failure was that in question two the concrete objects in front of the children conflict with what they are asked to imagine - the children cannot handle this conjecture.

When asked how they would try to establish the validity of these hunches all twelve teachers said that certain preliminary actions would be essential. First it would be necessary to check that children knew the colour names and secondly that they could name a set. Ten said it would be necessary to check that the children could build a set whilst six made the additional requirement that it would be necessary to check that the children were able to exclude from a set.

Accounts of checking specific hunches depended on which specific hunches had been made.

Of those who suggested that the word 'blue' was somewhat hidden, 6 suggested emphasising 'blue' and 4 suggested putting the second question last.

Of the eight who said that the hypothetical and confusing juxtaposition of diagrams and imaginary sets was too much for the child to cope with, four suggested presenting the whole problem with concrete objects.

It is clear that the teachers' views of complexity here concern the issues of clarifying the question's intention and of the representational and syntactic complexity of the task array. These are exactly the issues that many developmental psychologists currently concern themselves with.

The second task used here for illustrative purposes is shown in fig 2 as it appears in the children's workbooks. The word 'brown' within the set boundary indicates that the animals are to be coloured brown.

fig 2 about here.

When asked which of the animals is large, most children apparently say 'dog' and when asked which of the animals is small most say 'cat'. The exercise immediately preceding this one contains a set of similar triangles of various sizes and most children have no trouble, according to the teachers,

in selecting the large and the small objects. With reference to the set of animals the children are perceived to be confused. When asked to speculate what the source of confusion was, the following responses were obtained.

All twelve teachers said that it was possible that the children ignored this real-life knowledge of the animals and judged on diagram size. Eight suggested that it was possible that the children were not familiar with all the animals and for that reason judged on diagram size. Six made the further intriguing suggestion that the children were familiar with the animals to different degrees and their judgements depended on the quality of their experience. For example, it was suggested that for some children, their knowledge of cows and horses might be limited to media representations.

When asked how they would check out these hunches, all twelve teachers said it would be necessary to check out the children's knowledge of animals - and especially their respective sizes, if sense were to be made of their performance on this task. 10 said the same task could be given with the animals drawn to scale and six said that all the animals might be drawn the same size to force a real-life discrimination. All recognised that as a consolidation and transfer task this demanded more knowledge than the concept apparently being consolidated.

It is clear that these teachers were capable of generating a range of speculations about children's thinking which, at least at an intuitive level, is isomorphic with the kinds of speculation which developmental psychologists currently entertain. In addition the teacher's methods for assessing the validity of these hunches bear the hallmarks of sound experimental or critical exploration techniques.

But what actually happens in practice? The teachers were asked how they

typically treated these problem tasks in the classroom. With respect to the first task (shown in fig 1.) all the teachers said they gave it to all the children. All said that they had not time either for the preliminary establishment that children had the necessary prerequisite knowledge nor for structured amendments of the task. All twelve gave the task as it stands, four said that they 'put right errors later' and eight said that they did this by putting stress on the key colour words.

For the task shown in fig 2 eight of the twelve teachers said they missed it out entirely because experience showed that it was too confusing. Four said that they gave it to their top groups and discussed it.

IMPLICATIONS OF STUDY ONE.

What can be made of this kind of data? It is clear that some teachers can demonstrate sophisticated insights into task specific complexities when given the opportunity to do so. Equally clearly they have crude ways of selecting tasks for children or of amending tasks with the upshot that some children get severely truncated curriculums and most must get some strangely confusing experiences. (Erlwanger, 1975; Kent, 1978). It seems that whilst an appeal has been made not to ignore teachers' knowledge, teachers do so daily!

If there is an immediate role here to play for psychologists it is not to tell teachers how children think. Rather, it is to work with teachers in working through the teachers' own task specific thinking about children and to help in the design and presentation of tasks.

But there is a wider role to play in terms of the generation of a more adequate, general and theoretical understanding of classrooms that might impinge on course design and classroom practice. It must be recognised however, that the generation of such a classroom based theory of intellectual growth could not possibly stand on a basis of the ad hoc collection of the kind of data reported above.

For example, whilst Desforges and Desforges (1980) demonstrated that pre school children have an extensive, working understanding of sharing as a numerical process and that their strategies for dealing with sharing altered and in some respects were diminished possibly as a consequence of schooling, it is not easy to see how this kind of finding can be used to generate an understanding of the impact of schooling. Work towards a theory of intellectual growth as it obtains in classrooms must generate and test models of the processes which mediate between teachers' behavious and their impact on children's cognitions and vice versa.

MECHANISMS MEDIATING TEACHER EFFECTS

Classically, two mechanisms have been assumed or espoused namely, motivation and practice. Teaching behaviours have been seen to have had their effects on children's learning by maintaining on-task behaviour using selections from or combinations of discipline, practice, reinforcement, feedback and motivation. The limitations of these notions as candidates for mediating variables in learning are well documented elsewhere. (Doyle, 1980; Kimble, 1961) Both logically and empirically the quantity of on-task behaviour is at least as likely to be a result of, rather than a cause of learning. In any event it is recognised that the effectiveness of on-task behaviour depends crucially on the quality of that behaviour. In recognition of these limitations, attention has recently turned to the tasks that teachers give children as the major vehicle of intellectual transport from teacher to child. (Doyle, 1980; Resnick, 1976). The major feature of these 'task models' is that they concentrate on tasks as they operate in classrooms and ask questions about how teachers accommodate tasks to children, how children accommodate to teachers' tasks and what is assimilated by both parties in the task exchange.

In the final secion of this paper a second study of teachers' thinking is described in which the task model is the major heuristic. Its relationship

to contemporary developmental studies and its potential contribution to such studies are analysed.

STUDY TWO

The objective of this study (which is currently in progress) is to explore how teachers match tasks to children so as to optimise their learning progress (Bennett & Desforges, 1980). The children in question are in the age range 6;6 to 7;6 and work in a sample of 16 infants' schools in the North West of England. Before describing the conduct of the study it is necessary to elaborate on the task model which has guided the design of the study.

A number of assumptions are explicit in the task model. First, it is assumed that behaviour (including mental acts) adapts to the local environment - in this case the classroom. The pupils and teachers mutually respond and adapt to each other as they undertake the classroom tasks. The model further assumes that tasks are specified in very complex ways. Some aspects of tasks are specified very overtly, some aspects are specified by what the teacher reinforces or draws attention to and some task specifications are gradually generated over a long period of time and might not be noticeable to the casual observer.

Routines such as drawing a margin or putting the date on a piece of work might go unspecified but be punished if omitted. The reward structure of the classroom is assumed to play a potent part in specifying a task. In some classrooms, answering a question rather than giving the correct answer, appears to be the task. (Doyle, 1980)

Tasks specifications not only have complex histories. They are likely to be influenced by the way the teacher organises children in groups and hence by the opportunities children have to use peers as resources. Additionally, occasions for public performances by children represent very salient task-specification opportunities.

The materials teachers have available are complex sources of information which the child might use to obtain a task specification. For example in the number scheme mentioned earlier, the response demanded of the child is so frequently one of colouring set members that young children identify their work books as 'colouring books'. The desired response is so clearly signalled in a preliminary example to each exercise that children quickly learn the 'trick' and need deploy no cognitive strategy thereafter.

Thus in the task model the classroom is seen as a very complex source of information for specifying tasks. Children seek teachers' approval and consequently are assumed to adapt their performances to what they see as teachers' task specifications. The information flow is not assumed to be unidimensional. It has been shown that children resist changes in task specifications once established and that they might 'fix the rate for the job;' that is they lead the teacher to expect certain quantities or qualities of work.

Obviously the problem of interpreting these exchanges is seen to involve not only describing what teachers and children do in classrooms. It is necessary to analyse the participants' views of what they are about. The collection of pertinent data must necessarily involve observation, interview and clinical exploration techniques.

In this particular study each teacher is interviewed before school starts in the morning to establish her intentions (and her justification for those intentions) for two particular children that day. She is then observed as she distributes tasks. Two observers, one using a systematic schedule and the second taking field notes, then closely monitor the session's activities. Attention is focussed on the two target children and the teacher. Towards the end of the task period the second observer conducts an extensive interview with the child in an attempt to see the

task from his point of view. His specification of the task is probed as is his definition of what constitutes good work and task appropriate procedure. The interviews then turn into a clinical exploration study as the researcher attempts to probe the task's appropriateness to the child's intellectual structure. The fieldworker's strategy here is to present alternate and related versions of the task or sub tasks to explore how the child copes.

At the end of each school day the logs of the observation periods and the interviews are discussed with the class teacher.

The project is conceived as a research and development project. Any theory generated will be tested in the second phase. Any prescriptions for practice can be tried out in this second phase.

PEDAGOGIC STUDIES AND PSYCHOLOGY

This study has not been generated from psychological theory. Indeed the psychological literature of optimal task allocation has been found wanting. (Bennett and Desforges. 1980) The study is not entirely divorced from psychological theory and practice however. With particular reference to the interviews with children it is clear that psychological methods and concepts guide the procedures as the child's understanding of tasks is probed. For example, a faith in 'structure' is evident and, more overtly, concepts such as transfer, generalisation and organisation are used. The main undertaking however is not to impose psychological categories on the data obtained from children but rather to search for pedagogically useful categories.

Whether in school or not, most of us, children included, spend a lot of time in complex social environments which make cognitive demands on us. The line of thought here is to conceive of people's competence in these

situations as a strategy pool and the intent is to plot such pools for individuals in classrooms. Additionally, some situations evoke or inhibit the deployment of one strategy or another, some situations add to the strategy pool whilst other detract. The aim is to chart the form of these influences.

Pilot studies have shown that some people (children and teachers) are swept along by the current of these influences whilst others control the flow. Our interest is not to assert that control is more effective than swimming with the tide. Rather we are interested in describing the processes and outcomes of these adaptations.

Pilot studies have further shown us that children are far more sophisticated than many studies of cognitive development would have us believe. At the age of six, at least, many children have a wide range of strategies for manipulating classroom events and highly elaborate procedures for making sense of the cognitive content of their lessons. Additionally, the way teachers interpret children's sense making depends in part on their 'theory of children's thinking' (which this study offers opportunities to examine and revise) but also on many other pressures that impinge on her.

By seeking ways of categorising these forces it is hoped to contribute to an understanding of what goes on in classrooms.

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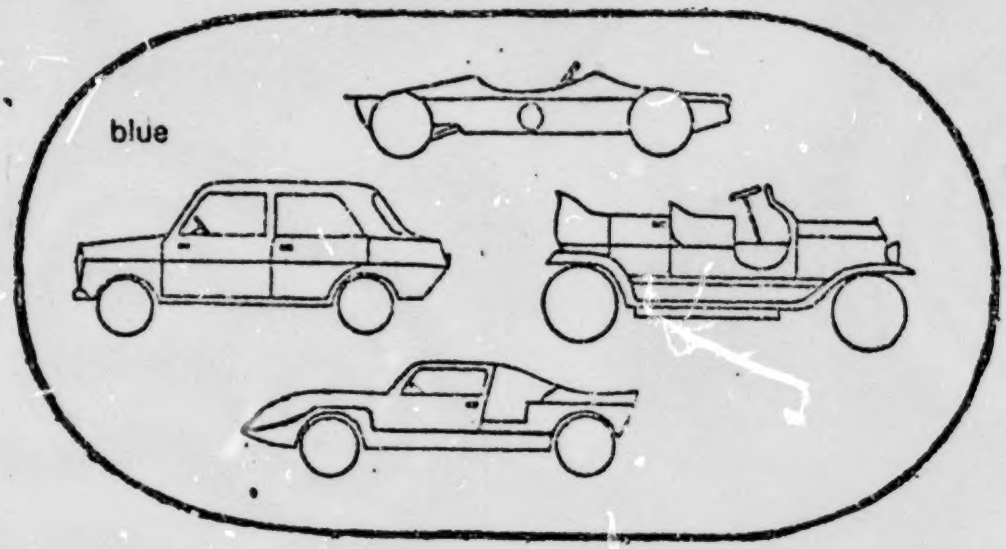
Fig. 1.



Questions asked.

1. If you coloured one car red, would you still have a set of cars?
2. If you coloured one car red, would you still have a set of blue cars?
3. Can a green car belong to a set of blue cars?

Fig. 2.

Two questions are asked.

1. Which of the animals on the page is large?
2. Which of the animals in the set is small?